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Works through
850
Interface
Module

GRAPHICS HARDCOPY

For your **ATARI™** Microcomputer

Version 3.0

- * Print any screen image to your parallel printer.
- * Compatible with BASIC, PILOT and Editor/Assembler.
- * Auto booting diskette - nothing else to load.

- * Works with these printers:
 - EPSON MX-70, MX-80, MX-80F/T (with GRAFTRAX),
 - MX-100 and FX series.
 - OKIDATA 82A (with OKIGRAPH), 84P (step 2), 92 and 93.
 - NEC 8023A
 - GEMINI 10 and 15.

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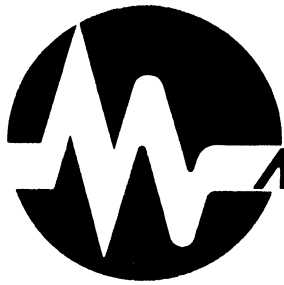
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Graphics Hardcopy Addendum

MACROTRONICS, inc.®

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GOOD NEWS!

This product now drives a compatible printer through the Atari 850 (or equivalent) Interface Module, as well as through the Macrotronics Parallel Printer Cable attached to Game Controller ports 1 and 2.

If you are driving your printer through the Atari 850 (or equivalent) Interface Module, simply ignore all references in this manual to the Macrotronics Parallel Printer Cable.

All commands, prompts and program addresses remain the same whether your printer is attached via the Atari 850 Interface Module or via the Macrotronics Parallel Printer cable.

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PREFACE

Yes, you really can obtain hard copy of all those neat graphics on your Atari video screen! "But do I really have to read through all this stuff just to see it print some graphics." Well - no, not really. Recognizing that most of us like to try out our new "toys" immediately, we have made every effort to get you "up and running" as quickly as possible. You will be able to get some printouts after reading only a few pages. Some of the more "exotic" features are going to take some learning, however, so please be patient - we'll get to them in good time.

The impatient reader may wish to skip over the "tutorial" approach and go right to the QUICK REFERENCE information in the appendix. However, no matter how impatient, be sure to read CHAPTER 1 before doing anything else. We strongly encourage you to read the manual in the order that the material is presented and learn to use the system properly the first time. It really is easier that way. You will spend less time frustrated by unexpected behavior and you will acquire the ability to fully utilize all the powerful capabilities of this package.

CHAPTER 1

Getting Started

INTRODUCTION

This product will allow your Atari computer to drive an Epson MX-70, MX-80*, MX-80F/T*, MX100, FX-80, NEC 8023A, Okidata 82A(with Okigraph), 84P(step 2 only), 92 and 93, or Gemini 10 or 15 printers through the front "Controller Jacks". This allows both text and hi-res graphics to be printed.

THE ATARI 850 (or any other) INTERFACE MODULE IS NOT NECESSARY

A cable plugs into controller jacks 1 and 2 and does not interfere with normal typing on the Atari keyboard. A ribbon cable attaches to your printer through an appropriate connector. A short machine language program is "automatically" booted into the Atari from diskette.

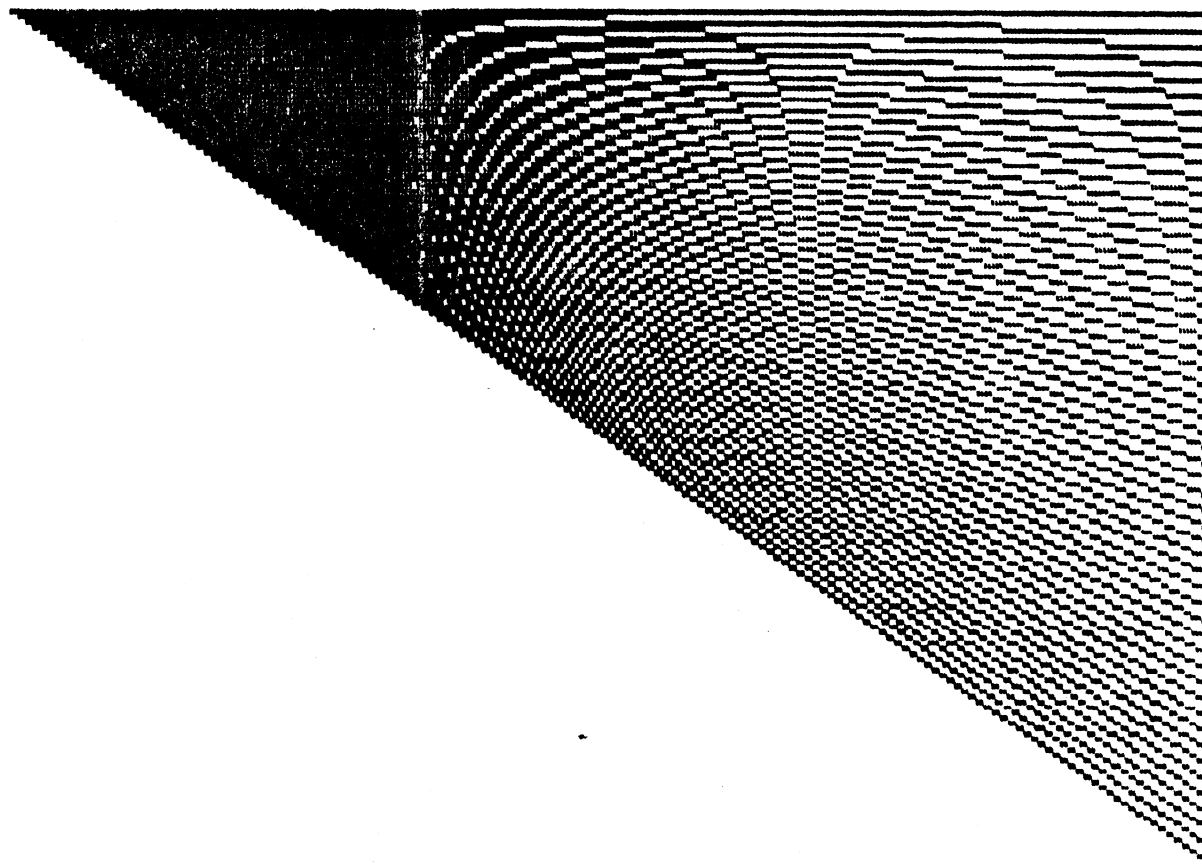
This program and interface will enable you to do the following:

1. Copy the graphics and text image on your monitor to the printer.
2. List a program using the LIST"P:" or LIST#P: commands.
3. Direct data to the printer under your program control, for example with the "LPRINT" command in BASIC.

* Epson MX-80 and MX-80F/T require GRAFTRAX option.

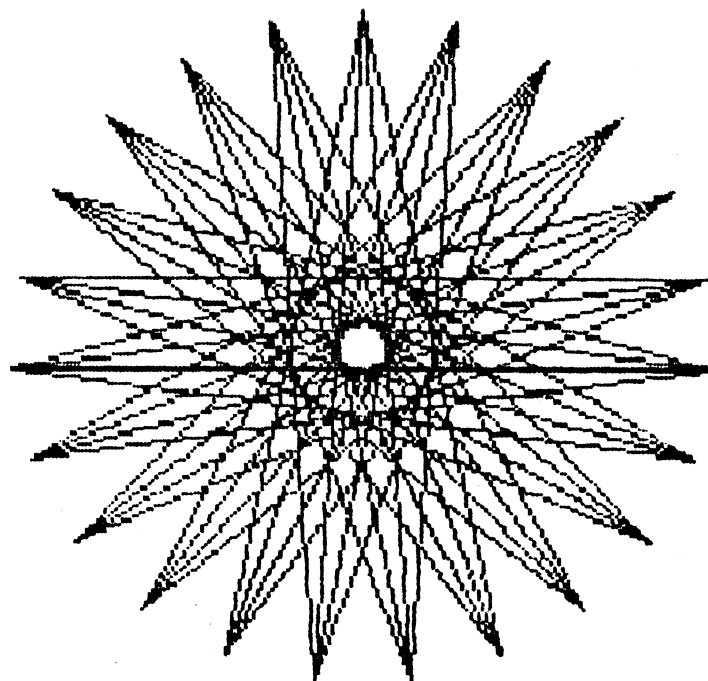
EXAMPLES

The screen images on the next few pages were printed using this product. The screens were created using programs listed in Appendix B of this manual.

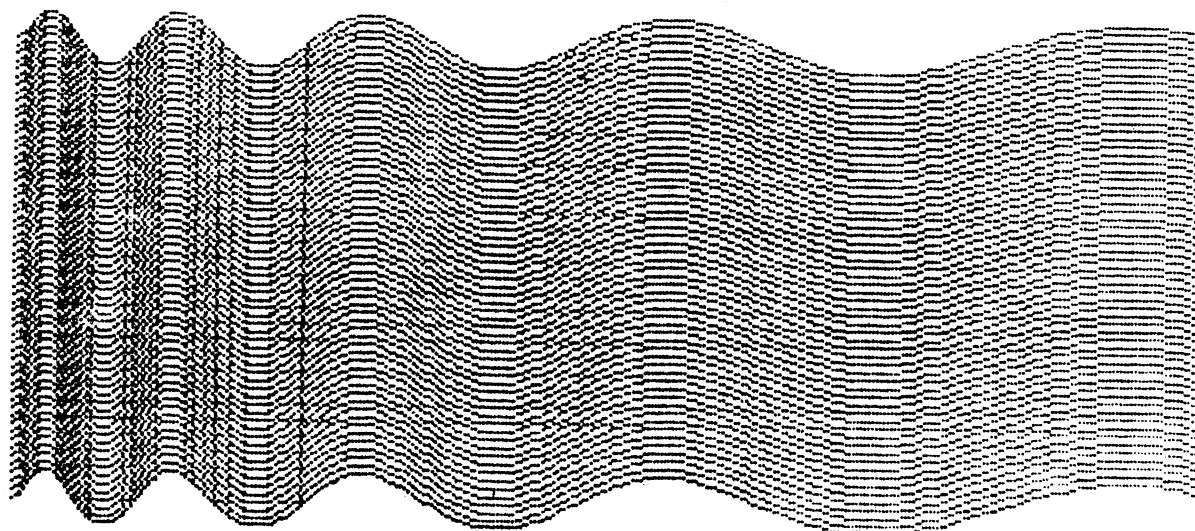


ATARI'S SPECIAL LIGHT SHOW

Screen 1



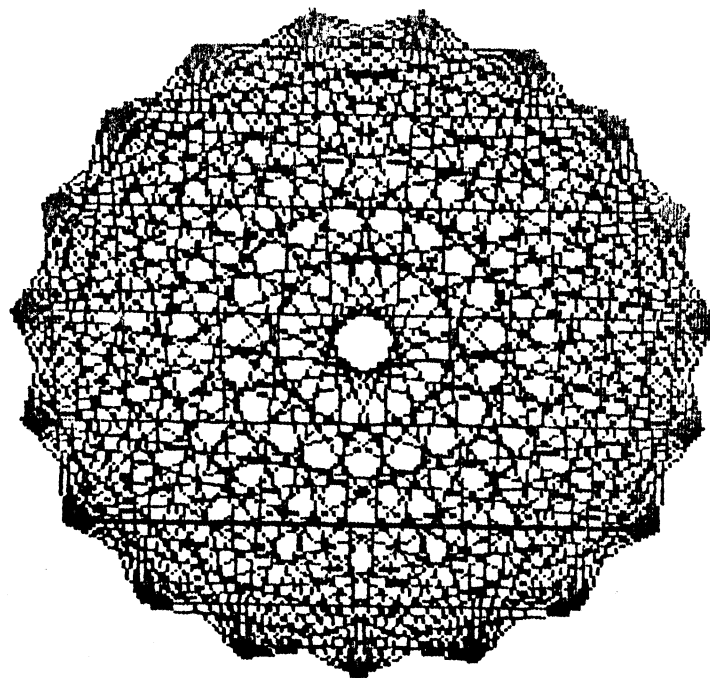
Screen 2



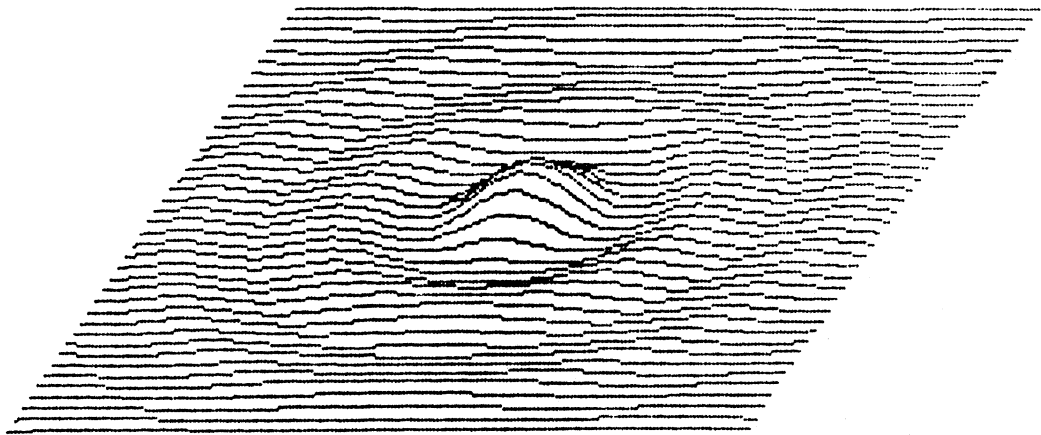
Screen 3



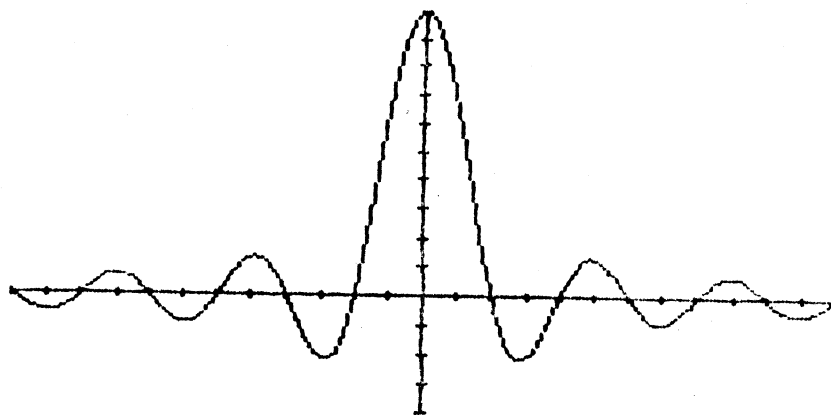
Screen 4



Screen 5



Screen 6

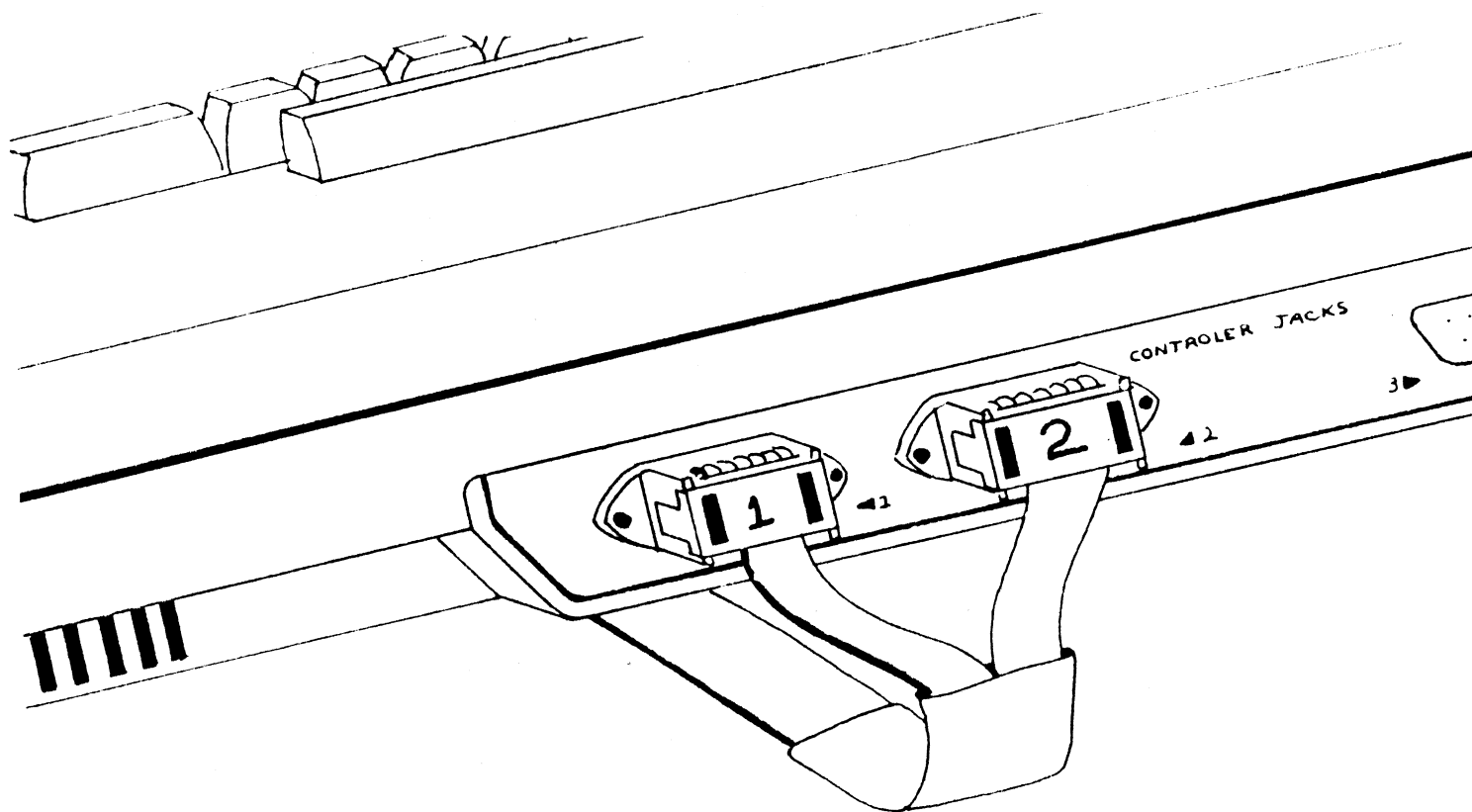


$$Y = \sin(X) / X$$

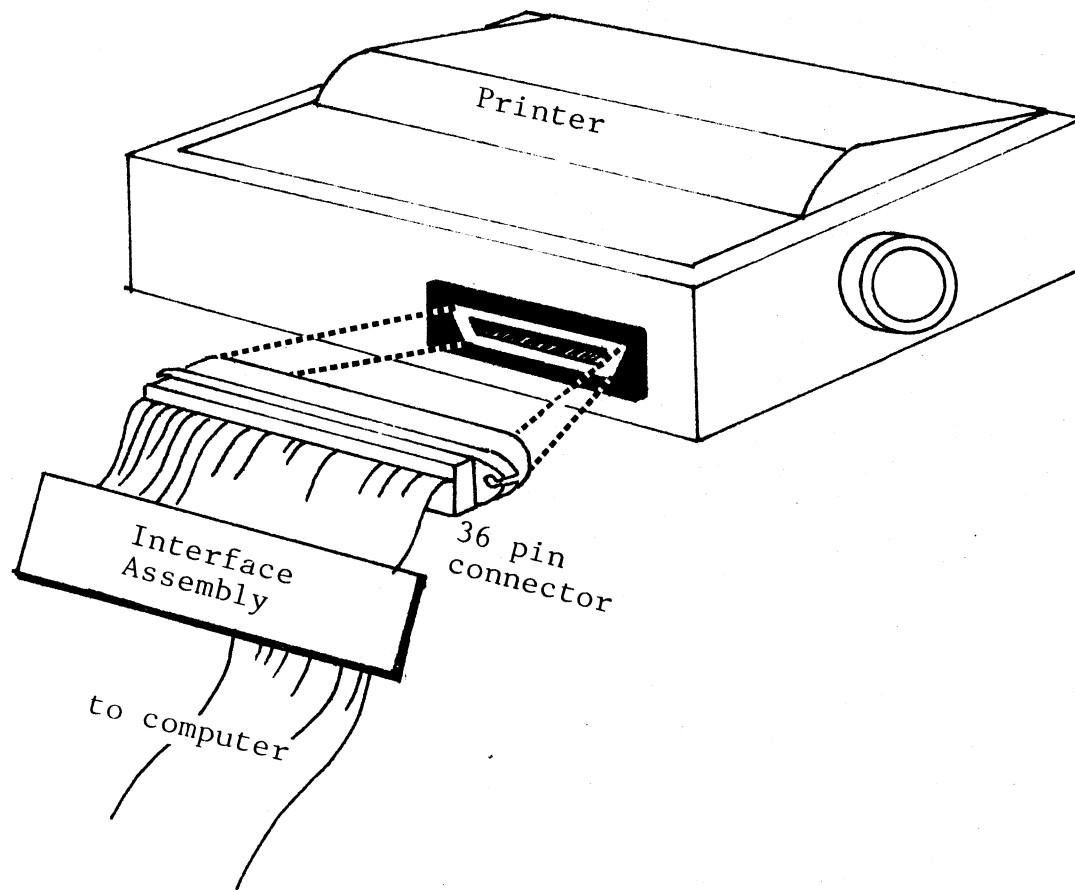
Screen 7

CONNECTION

Plug the two DB-9, nine pin, connectors into Controller Jacks 1 and 2 on your Atari microcomputer. The following figure illustrates the connector positioning.



The 36 pin connector plugs into your printer as illustrated in the typical example below.



Screen printer interface connection to printer.

MAKING A BACKUP

We strongly recommend that you work with a backup copy of the Macrotronics disk and put the original aside for safekeeping. Here's how to make a backup copy.

1. Boot the Macrotronics disk.
2. Go to DOS by typing : DOS<RETURN>
3. Insert and initialize a blank diskette using Menu item I.
4. Duplicate the original disk onto the new disk using Menu item J.

LOADING THE SOFTWARE

The program which accompanies the screen printer interface directs data to the Controller Jacks. The program will remain in memory as long as the computer stays on. It is only necessary to reload the software when the computer has been subsequently turned off.

You must plug the Macrotronics interface cable into controller jacks 1 and 2 BEFORE loading any of the Printer Driver Software.

Next boot the backup disk as follows:

1. Turn off the computer, disk drives and other attached accessories.
2. Turn on disk drives.
3. Turn on other attached accessories (ie. printer, video monitor, etc).
4. Insert the backup copy of the disk in Drive 1 and close disk drive door.
5. Turn on computer. Disk drive 1 will start and the program will load automatically.

6. Once the program is loaded the following will be displayed:

MACROTRONICS, INC.

PRINTER (0-5)?

Note: If the printer selection prompt message is not displayed then check your interface cable and connector. If the interface cable and connector are not properly attached, the software will not execute properly.

7. Enter the number indicating your printer type:

- 0 - Centronics 739*
- 1 - Trendcom 200*
- 2 - IDS 440G* or 445G*
- 3 - Epson MX70, MX-80, MX-100 & FX-80
- 4 - Okidata 82A (with Okigraph), 84P(step 2), 92 & 93
- 5 - Nec 8023A

*Note: Software supports these printers, but the connector on the printer end of the cable will have to be changed. Contact Macrotronics Technical Services for assistance. .

8. The screen print program is now loaded, initialized, and ready to use.

Remember, this program will work ONLY with the Macrotronics Parallel Interface cable and connector attached to controller jacks 1 and 2. It will not work through the Atari 850 Interface Module.

CHAPTER 2

What You Can Do

USING THE SCREEN PRINT INTERFACE

After you have connected the Macrotronics cable assembly to controller jacks 1 and 2, and your printer, booted the software and selected the printer type, you are ready to print graphics and text data with your printer.

There are essentially three ways to print data:

1. LPRINT

The printer software will direct text specified in an "LPRINT" statement to your printer. LPRINT may only be used from BASIC. Refer to the "LPRINT" section for examples.

2. LIST"P:" or LIST#P:

The printer software will direct all or specified portions of a program listing to your printer. The commands are used from BASIC and Assembler respectively. Refer to the "Program Listings" section for examples.

3. GRAPHICS SCREEN PRINT

The printer software will direct the data shown on the screen (graphics data as well as text data) to your printer. Refer to the "Screen Print" section for more details.

LPRINT

To obtain printer output from a BASIC program use the "LPRINT" command.

Example: FOR I=32 TO 90: LPRINT CHR\$(I);: NEXT I

To print this:

!"#\$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ

You may only use LPRINT from BASIC.

If you want to stop the printer before it is done, use the "BREAK" key or "ESC" key - not the "MASTER RESET".

PROGRAM LISTINGS

To obtain printer output of a BASIC program listing use:

LIST"P:" To print the entire program or
LIST"P:",XX,YY to print only lines XX through YY.

To obtain printer output of an assembly source listing use:

LIST#P: To print the entire program or
LIST#P:,XX,YY to print only lines XX through YY.

You may only use LIST"P:" from BASIC and LIST#P: from the assembler. If you want to stop the printer before it is done, use the "BREAK key or "ESC" key - not the "MASTER RESET".

SCREEN PRINT

You can transfer graphics and text data displayed on the video monitor to your printer. The graphics data will be printed in simulated "Grey Scale". The darkness of the image is determined by the value of luminance in the color register. Refer to the "Graphics" chapter in the Atari BASIC manual for an explanation of the use of color registers. The text characters may be printed in simulated grey scale or in black and white. See figure 1 for an example of the 8 different luminance levels.

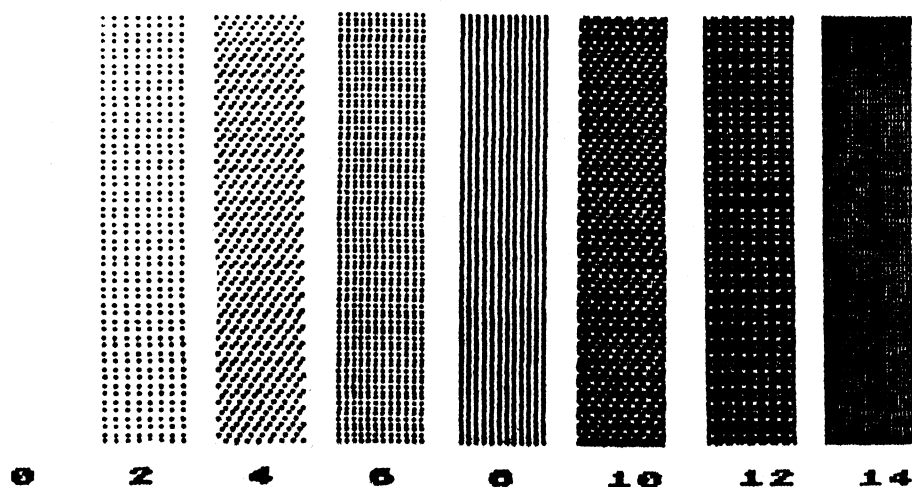


Figure 1 LUMINANCE LEVELS

The following section explains how to print whatever is displayed on your video monitor:

1. Load the Screen Print Program as explained in the "Loading Software" section of this manual.
2. Load and execute a BASIC program which displays a desired screen image. For example, run the "POINTS" demo program which is included on the Macrotronics distribution disk as follows:

Type in:

```
RUN"D:POINTS.BAS"<RETURN>
```

After a minute or two you should see a graphics pattern similar to Screen 2 in CHAPTER 1.

3. If you press CTRL-P you should obtain a copy on your printer.

To try another example, enter the following program:

```
10 GRAPHICS 3
20 SETCOLOR 0,8,4
30 SETCOLOR 1,8,8
40 SETCOLOR 2,8,12
50 COLOR 1: PLOT 0,14: DRAWTO 39,14
60 COLOR 2: PLOT 0,16: DRAWTO 39,16
70 COLOR 3: PLOT 0,18: DRAWTO 39,18
```

Then type RUN.

The screen will display 3 luminance levels of blue lines.

To print the image on the printer, hold down the "CTRL" key and press the "P" key; when both keys are released the printer will print the following:

```
////////////////////////////////////  
|||||  
=====
```

READY

Note how everything on the screen, including the "READY", was printed. In this case you initiated the screen image print from the keyboard. The "Keyboard Control of Screen Print" section of this manual summarizes this procedure.

Instead of initiating the screen print from the keyboard, you may wish to have your BASIC program initiate the screen image print. You can do this by using the "USR" command in your BASIC program. For example, add line 80 to your sample program as shown below:

```
10 GRAPHICS 3  
20 SETCOLOR 0,8,4  
30 SETCOLOR 1,8,8  
40 SETCOLOR 2,8,12  
50 COLOR 1: PLOT 0,14: DRAWTO 39,14  
60 COLOR 2: PLOT 0,16: DRAWTO 39,16  
70 COLOR 3: PLOT 0,18: DRAWTO 39,18  
80 X=USR(7513)
```

Then type RUN.

This program causes the printer to print the screen image automatically. This use of the "USR" command is explained in detail in the "Program Control of Screen Print" section of this manual.

The screen image data was printed on the printer in grey scale. The grey scale for each line was different because each line was printed using a different color register. In line 50, color register 1 was selected with the "COLOR 1" command. Then the bar was drawn across the screen with the PLOT 0,4 and DRAWTO 39,14 instructions. The other two lines were drawn in a similar manner but each was drawn using a different color register. The actual color and luminance of each color register was determined with the SETCOLOR command in lines 20, 30 and 40.

Let's see how line 20 "SETCOLOR 0,8,4" works. In the graphics chapter of the Atari BASIC Manual we find a table entitled "Mode, Setcolor, Color Table". Look down the "Setcolor" column and across the row for "Graphics Mode 3, 5 and 7", (we are in graphics mode 3): notice that SETCOLOR 0 corresponds to color register 1 in the "Color" column of the table. Therefore, the value of the color register will be hue 8 and luminance level 4. Hue 8 is blue and luminance level 4 is dim. This is the hue and luminance of the top bar.

The grey scale of this screen print was determined only by luminance levels - the hue information was not used. In our example the hues of the three bars are all the same but the luminances are different.

CHAPTER 3

How To Do It

KEYBOARD CONTROL OF SCREEN PRINT

To summarize, you can obtain a printout of anything displayed on the Atari video screen as follows:

1. Turn off the computer
2. Be sure the printer is connected via the Macrotronics cable to controller jacks 1 and 2 and is turned on.
3. Insert the desired ROM cartridge (BASIC, Assembler, PILOT, etc.).

Note: Cartridges which take immediate control of the computer, such as Star Raiders, Basketball and Chess do not allow disk booting. The Screen Print Package cannot be used with cartridges which do not allow a disk to boot.

4. Turn on disk drive(s). Wait for the red light to go out.
5. Insert the Screen Printer diskette in disk drive 1 and close the door.
6. Turn on the computer.
7. Enter the appropriate printer number:

0 = Centronics 739
1 = Trendcom 200
2 = IDS 440G or IDS 445G
3 = Epson MX-70, MX-80, MX-80F/T, MX-100 & FX-80
4 = Okidata 82A (with Okigraph), 84P(step 2), 92 & 93
5 = Nec 8023A

8. Load and execute your applications software

9. When the desired image is displayed on the video screen, press CTRL-P.

10. Your applications program will stop executing while the screen dump takes place. Execution of your applications program will resume when the dump is complete.

A variety of options are available to alter the size and appearance of the printout. These are explained in CHAPTER 4.

It is important to keep in mind that each screen display may require a bit of experimentation with printout options in order to obtain the best looking hardcopy. For example, some displays will look best when printed with black characters on a white background, while others will look best inverted (simply press the Atari Logo key) with white characters on a black background.

Similarly, you may have to try various combinations of System v.s. Screen Printer color registers and grey scale patterns on either hue or luminance. If your printout looks "washed out", if patterns are not easily distinguished, or if text characters printed in the high resolution graphics mode (8) are barely readable, then you almost certainly should try changing one or more of these options to obtain a nicer looking hardcopy.

Another consideration is aspect ratio. You may wish to alter either the horizontal or vertical scale in order to obtain better looking proportions in your printout.

In general, then, each display will require a unique combination of option settings for the most attractive printout.

PROGRAM CONTROL OF SCREEN PRINT

UNDER PROGRAM CONTROL USING "RUNFLG".

The Program contains an execution flag Byte called "RUNFLG".

RUNFLG is located at: Decimal 7523
Hex 1D63

Once the program has been initialized, each 1/60th second interrupt generates a jump into the utility to test RUNFLG. If RUNFLG is zero, it is ignored, and a return (RTS) takes place. If RUNFLG is non-zero, the screen dump to printer takes place before the return. In this way, you can initiate a screen dump by changing one RAM location. This is convenient in the higher level languages with a POKE or in machine code with an STA. RUNFLG will be zeroed upon completion of the screen dump.

One word of caution in using RUNFLG. The start of the screen dump to printer will not take place IMMEDIATELY upon execution of the POKE to RUNFLG. It might take as long as 1/60th of a second after the POKE until the next interrupt occurs and the screen dump takes place. A lot of code can be executed in 1/60th of a second! If you want to be absolutely certain that the screen does not change before the screen dump takes place, put in a test of RUNFLG before proceeding with your code. For example, in BASIC:

```
5 RUNFLG = 7523
10 PRINT "Anything"
20 POKE RUNFLG,1
30 IF PEEK (RUNFLG)<>0 THEN 30
40 REM Continue your program
```

UNDER PROGRAM CONTROL USING A JUMP TO SUBROUTINE.

An alternative to a POKE to RUNFLG is a direct jump into the utility at the appropriate entry point.

BASIC language users may execute the utility with the "USR" command.

Example: X = USR (ENTRY1)

Where "ENTRY1" equals: Decimal 7513
 Hex 1D59

If another argument is used, it will be used as the decimal address of a player missile area. This will be explained in the next section. Any additional arguments will be ignored.

PILOT language users may execute the utility with a "CALL" command.

Example: CALL:ENTRY2

Where "ENTRY2" Equals: Decimal 7516
 Hex 1D5C

Assembly and machine language users may also execute the utility with a Jump to Subroutine at the same location.

Example: JSR \$1D5C

In machine code, the Jump to Subroutine is actually simpler than changing RUNFLG. It also has the advantage of an IMMEDIATE screen dump to printer, and the RUNFLG test to resume execution is not necessary.

ABORTING

If you wish to abort a screen dump once it has started, press the escape (ESC) key or the "BREAK" key. The "MASTER RESET" key will always abort the dump, but it has been found to occasionally mess up the stack and should be avoided.

CHAPTER 4

Advanced Features

SCREEN PRINT FEATURES

The screen dump will print both text and graphics. Printing is done under direct control of the print head on a dot-by-dot basis. The printer character font table is not used. Printouts of text may look considerably different than conventional printing. Text using the utility will approximate the font used in the Atari video generator. In other words, you will get a hardcopy of what you see on the screen.

Considerable flexibility in the printout is available. In particular, you may wish to:

1. Increase the size or proportion of the printed image.
2. Print black on white or white on black using the Atari Key.
3. Print in "grey scale" or black and white.
4. Determine grey scale from hue information instead of luminance information
5. Print data which has been "fine scrolled".
6. Print players and missiles.

These options are preset with default values to accommodate typical requirements for a graphics screen dump, but may be changed by the user if desired.

SCALING

The size of the printed image may be varied independently in both horizontal and vertical axes with two variables: VMODS and HMODS.

VMODS is located at: Decimal 7525
Hex 1D65

HMODS is located in the next memory location: Decimal 7526
Hex 1D66

VMODS is the variable used to set the vertical scale. It must be an integer less than or equal to 16 and greater than 0. VMODS is the denominator of the fraction:

$$\text{Vertical length} = 16 / \text{VMODS}$$

Therefore, as VMODS increases, vertical length decreases.

HMODS is the variable used to set the horizontal scale. It must be an integer less than or equal to 16 and greater than 0. HMODS is the denominator in the fraction:

$$\text{Horizontal width} = 16 / \text{HMODS}$$

Therefore, as HMODS increases, horizontal width decreases. HMODS and VMODS may be changed independently to achieve the desired aspect ratio.

As the horizontal scale increases to the point that the image will no longer fit on a single strip of paper the remaining unprinted portion will carry over and print in a second strip below the first strip. These strips may be aligned and taped together to give an enlargement wider than the printer paper.

REVERSE IMAGE

Normally the printer prints black images on a white background. You can reverse the image to print white on a black background by simply pressing the Atari (J10) key on the keyboard. This key "toggles", so press it again to return to "normal". Figure 2 illustrates "normal" and "reverse" images.

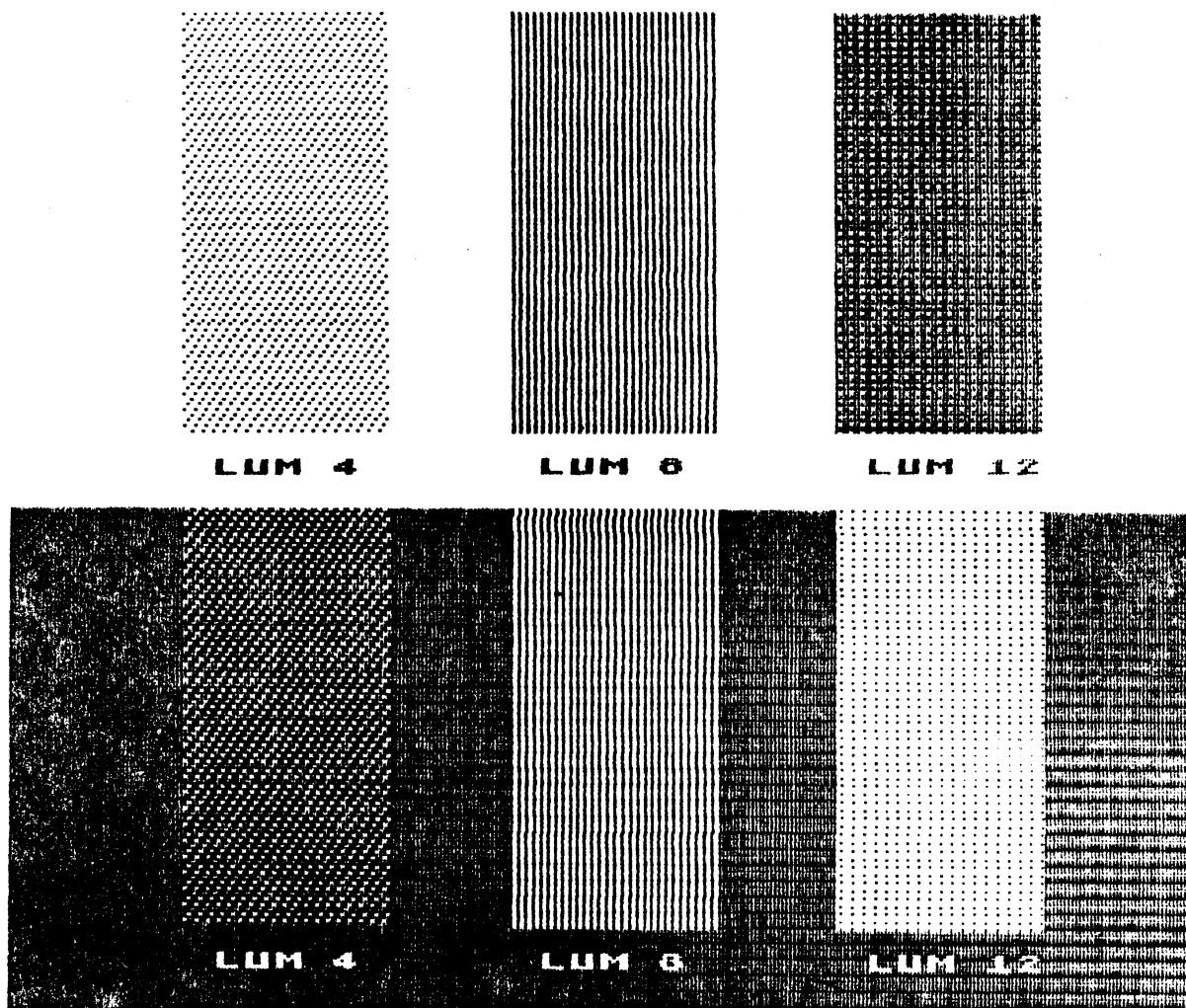


Figure 2 Normal and Reverse images

GREY SCALE

Obviously, the screen dump utility program cannot reproduce a color video display EXACTLY on a printer which has only black and white capability. An approximation of some sort is required. The program uses eight different dot patterns to approximate a grey scale. But how to represent various "colors" in the grey scale is itself a problem, because "color" consists of both hue and luminance.

You can select whether the grey scale should correspond to luminance OR hue (but not both). In the default condition the grey scale corresponds to luminance. This means two areas on the screen may look different because they differ in hue, but they will print exactly the same if they have the same luminance (assuming the default condition). Conversely, if grey scale is printed according to hue, two areas on the screen may look different because of a difference in luminance, but print the same because the hue is the same.

Figure 3 illustrates the eight grey scale patterns corresponding to either luminance or hue levels. (Remember, you can print the scale based on luminance OR hue but not both.) The user may select luminance or hue for grey scale by setting or clearing bit 6 in variable STATUS. Specifically, grey scale will correlate with luminance if bit 6 is zero, or correlate with hue if bit 6 is 1 (see next section).

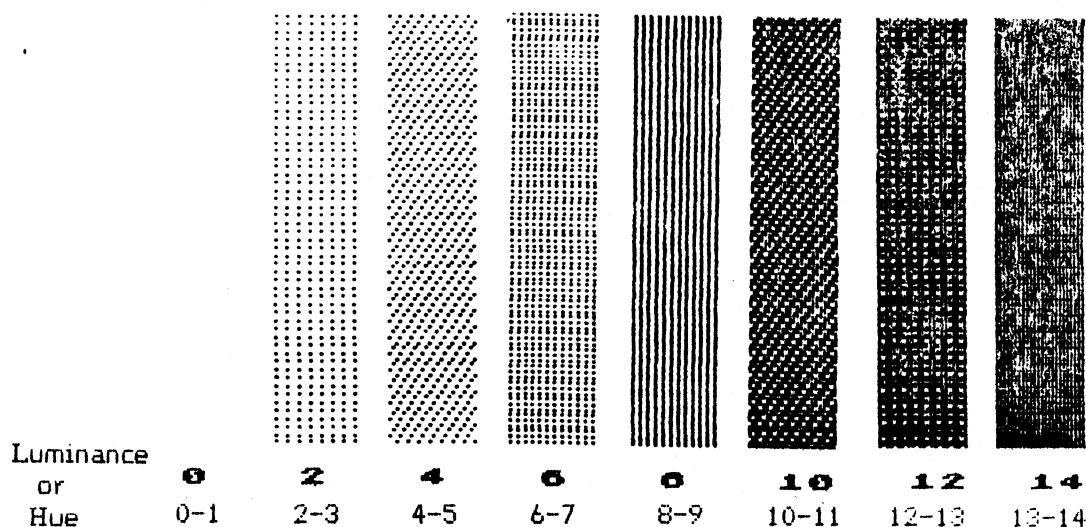


Figure 3 Eight Grey Scale Patterns

STATUS BYTE

The STATUS byte allows the user selection of several options in addition to grey scale. Table 1 briefly describes these. The STATUS byte is located at:

Decimal 7527

Hex 1D67

Table 1. - STATUS Byte bit assignments

Bit	DESCRIPTION OF OPTION (Default = CLR)
7	CLR = Screen Printer "color" registers are used SET = System color registers are used
6	CLR = Use Luminance for grey scale SET = Use Hue for grey scale
5	CLR = Text prints in black and white SET = Text prints in grey scale
4	CLR = Players print in black and white SET = Players print in grey scale
3	CLR = Missiles print in black and white SET = Missiles print in grey scale
2	Not used
1	Not used
0	Not used

SCREEN PRINTER COLOR REGISTERS

If the various hues are close to the same value and the various luminances are nearly the same brightness, then the grey scale patterns printed will be very similar or perhaps identical. This would make it difficult to distinguish the different areas of the image. In this situation the user may wish to print the screen using a different set of patterns.

A set of alternate color registers has been provided and may be used by setting "STATUS" Bit 7 off (default condition). Now the picture will be printed using a pre assigned selection of grey scale patterns. This frequently results in a better looking and more easily discernable printout of the image. Two different sets of patterns are provided, one for hue and one for luminance, so the printout should look different depending upon the state of Bit 6.

The user may change the values of these registers the same way the system color registers are changed. The preset registers are organized in the same way as the system registers located at Hex location \$2C0 through \$2C8. The preset registers are located at:

Decimal	7544 thru 7552
Hex	1D78 thru 1D80

TEXT GREY SCALE

If Bit 5 is set, text will be printed in the grey scale pattern corresponding to the appropriate color register setting. Text usually looks best printed in a "solid" pattern, therefore, so the default value for Bit 5 ignores grey scale on text characters.

PLAYER/MISSILE GREY SCALE

Bits 3 and 4 are similar to Bit 5. They select grey scale or "solid" patterns for Players and Missiles, respectively.

FINE SCROLLING

Lines on the screen that have been fine scrolled horizontally or vertically may be accurately printed, provided the user updates the program's scrolling registers whenever he changes the Atari system CTIA registers. The Atari computer system stores fine scroll data in "write-only" registers. It is necessary for the user to make this information available to the screen dump program

The Horizontal Scroll Register is located at: Decimal 7528
Hex 1D68

This Register must contain the same value as the corresponding CTIA Register at 54276 (\$D404 Hex).

The Vertical Scroll Register is located at: Decimal 7529
Hex 1D69

This Register must contain the same value as the corresponding CTIA Register at 54277 (\$D405 Hex).

PLAYERS AND MISSILES

Players and Missiles will be accurately printed provided the user updates 14 bytes of data relating to Player/Missile size and location. Since the system stores Player/Missile data in "Write-only" system registers, it is necessary for the user to make this information available to the screen dump program. The purpose and location of the needed data is as follows:

System Write Only Registers	Decimal Location	Hex Location	Purpose
54279	7530	1D6A	1. Player-Missile Vertical Data Byte Address (high order Byte only).
53248	7531	1D6B	2. Horiz. Position of Player 0
53249	7532	1D6C	3. Horiz. Position of Player 1
53250	7533	1D6D	4. Horiz. Position of Player 2
53251	7534	1D6E	5. Horiz. Position of Player 3
53252	7535	1D6F	6. Horiz. Position of Missile 0
53253	7536	1D70	7. Horiz. Position of Missile 1
53254	7537	1D71	8. Horiz. Position of Missile 2
53255	7538	1D72	9. Horiz. Position of Missile 3
53256	7539	1D73	10. Horiz. Size of Player 0
53257	7540	1D74	11. Horiz. Size of Player 1
53258	7541	1D75	12. Horiz. Size of Player 2
53259	7542	1D76	13. Horiz. Size of Player 3
53260	7543	1D77	14. Horiz. Size of All Missiles

CHAPTER 5

Related Information

DISTRIBUTION DISK FILES

The Macrotronics Screen Printer Interface distribution diskette contains the following files:

1. AUTORUN.SYS Auto booting file. Contains the Screen Printer software driver on the original distribution disk. Either LOPRINT or HIPRINT can be copied into AUTORUN.SYS if desired.
2. SCREEN.II Screen Printer software driver. This is the object code file which was also copied to AUTORUN.SYS on the distribution disk.
3. LOPRINT Parallel Printer Interface software driver residing in Page 6 of RAM memory. This is much shorter than the Screen Printer software. This program directs only text (not graphics) to controller Jacks 1 and 2 using LPRINT or LIST. Compatible with BASIC, Editor/Assembler and PILOT cartridges, Not compatible with AtariWriter.
4. HIPRINT Parallel Printer Interface software driver residing at \$1D80 which does not use Page 6 of RAM memory. This program is much shorter than the Screen Printer software and directs the text to Controller Jacks 1 and 2 using LPRINT or LIST. Compatible with AtariWriter, BASIC, Editor/Assembler and PILOT cartridges. Must use a MEM.SAV file if you intend to go back and forth to the DOS menu.
5. POINTS.BAS A BASIC language program to test the Screen Print software. Simply boot the screen Printer Driver and then load and run POINTS with the BASIC language cartridge.

MEMORY REQUIREMENTS

The amount of memory required varies according to the printer type. On the average, the program uses 2176 bytes of memory.

An Atari computer equipped with 8K of memory only has 5134 bytes available normally. When this program is loaded the user will only have 2958 bytes left for his program. This is not enough RAM to support graphics modes 7 and 8.

If your computer has 16K of memory, you can use all 8 graphics modes. Graphics mode 8 requires the most reserved memory (7900 bytes). With graphics mode 8, you still have 3K of memory for your program.

TECHNICAL NOTES

1. This interface uses open collector transistor circuitry to drive the printer data bits. This type of circuit assumes that the printer has "pull-up" resistors on the input bits (including strobe).

2. The printer "busy" signal must be TTL compatible and give a "high" (+5V) when the printer is busy and a "low" (0V) when the printer is able to accept new data.

The present versions of the Trendcom 200, Epson MX-70, MX-80 MX-100, FX-80, Nec 8023A and Okidata 82A, 84P, 92 & 93, Centronics 739 and the IDS 440G and 445G Paper Tiger printers satisfy both requirements.

SERVICE

There are no user replaceable parts in this product. If required, service should be performed by qualified service personnel. In the event service is required, we suggest that you first contact the dealer from whom the interface was purchased. The dealer may be able to provide local service. If local service is not available, return the entire interface (hardware and software) by insured, prepaid mail (parcel post, U.P.S. or Air freight), to:

Macrotronics, inc.
1125 N. Golden State Blvd.
Turlock, CA 95380

Ship in the original carton or securely packed in a cardboard carton with at least one inch of cushioned packing material on all sides. Enclose a clear description of the problem experienced, proof of purchase date and return address. Refer to the "Waranty" section of this manual to determine if your unit qualifies for warranty service. All other service must be paid in full before the unit will be returned to the user.

APPENDICES

APPENDIX A

SUMMARY OF IMPORTANT PROGRAM LOCATIONS

DOS 2.S ADDRESSES

Hex	Decimal	V A R I A B L E
1D50	7504	ORIGIN & AUTORUN
1D53	7507	BASIC init vector
1D56	7510	Application init vector
1D59	7513	BASIC execute vector
1D5C	7516	Application execute vector
1D63	7523	RUNFLG
1D64	7524	Error code
1D65	7525	VMODS vertical scaling
1D66	7526	HMODS horizontal scaling
1D67	7527	STATUS
1D68	7528	HSCROLL horizontal scroll register
1D99	7529	VSCROLL vertical scroll register
1D6A	7530	Player/Missile Vertical Data Byte Address (high order byte only)
1D6B- 1D77	7531- 7544	Player/Missile data 13 bytes

APPENDIX B

ERROR CODES

The screen print program may abort execution for a variety of reasons. The cause is indicated in an error code at:
Decimal 7524
Hex 1D64

The Error Codes and corresponding error conditions are as follows:

Error Codes	Cause
1	No error - the screen print program ran successfully.
128	The BREAK key was pressed during program execution.
240	The ESCAPE key was pressed during program execution.
241	The RESET key was pressed during program execution.
251	No DMA - Video DMA disabled.
252	The printer failed to open properly.
253	The Serial I/O Bus is active. The program will not execute unless the Serial Bus is free.
254	The system printer buffer is not empty indicating that the printer is in use. The program will not execute if the printer is busy at the time the program is called.
255	The screen print program has not been initialized yet. It must be initialized prior to program execution.

* All error codes are in decimal

APPENDIX C

Conflict with DOS 2.0

The present location of the utility program is such that a call to DOS may destroy vital entry point jump vectors. Consequently, the user has two options:

1. When the user completes his activity with the DOS Menu, he must reboot the disk to AUTORUN the utility.
2. The user may use the following procedure to avoid having to reboot the disk:

- a. Before starting the programming session, a MEM.SAV file should be created on the working disk as follows:

- i) Go to DOS 2.0
- ii) Create a MEM.SAV file with Menu item "N".

- b. Turn off the computer, wait five seconds, then turn it on again to boot the utility disk.

- c. Resume your programming session. Now when DOS is called, the utility will be saved in the MEM.SAV file. When the user completes his activity with DOS by using Menu item "B" the utility will be automatically restored by the MEM.SAV file.

- d. The utility needs to be reinitialized to restore needed Jump vectors before it can be executed from the keyboard (CTRL-P) or poking RUNFLG. Reinitialize as follows:

- i) BASIC language users initialize the utility with the USR command.

Example: X = USR (INIT1)

Where INIT1 equals: Decimal 7507
Hex 1D53

All other arguments will be ignored.

ii) PILOT language users initialize the utility with the "CALL" command.

Example: CALL:INIT2

Where INIT2 equals: Decimal 7504
Hex 1D50

iii) Assembly language users initialize the program with a Jump to Subroutine at the same location.

Once initialized, the utility will respond properly to the keyboard (CTRL-P) and RUNFLG initiated execution.

APPENDIX D

PROGRAM LISTINGS

The programs used to create the screen images printed in Chapter 1 of this manual are described as follows:

Screen 1

This screen image was created using the sample program "Light Show" listed in an Appendix of the Atari BASIC Manual.

Screen 2

This screen image was created with the following program:

```
10 REM *** CIRCLE GRAPHICS ***
20 PNTS=13
30 SKIP=0
40 RNG=94
50 SETCOLOR 1,8,14
60 COLOR 1
90 REM ** COMPUTE GRAPHICS **
100 DIM X(50),Y(50)
110 DEG :D=360/PNTS
120 FOR I=0 TO PNTS-1
130 Y(I)=96-COS(D*I)*RNG
140 X(I)=160-SIN(D*I)*RNG
150 NEXT I
190 REM ** PLOT DRAWING **
200 GRAPHICS 8+16
210 F=0:T=SKIP+1:I=0
220 PLOT X(0),Y(0)
230 IF T>PNTS/2 THEN 300
240 I=T+I:IF I>=PNTS THEN I=I-PNTS
250 DRAWTO X(I),Y(I)
260 IF I>0 OR F=0 THEN F=1:GOTO 240
270 T=T+1:I=0:GOTO 230
280 REM ** PRINT SCREEN IMAGE **
290 RETURN
300 GOTO 300
```

The value of "PNTS" in line 20 represents the number of points in the circle; "PNTS" must be prime. The value of "SKIP" in line 30 represents the number of points skipped when the first line is drawn; "SKIP" must be less than 1/2 the value of "PNTS". Screen 2 was created with "PNTS=23" and "SKIP=9".

Screen 3

This screen image was created with the following program:

```
10 GRAPHICS 8+16
20 YMAX=10
30 VAR=1.0E-05
40 CONST=1E-04
50 SETCOLOR 1,8,14
60 COLOR 1
100 DEG
110 FOR I=YMAX+1 TO 192-YMAX STEP 3
120 PLOT 0,I
130 SCALE=0.5:X=1
140 FOR J=6 TO 1600 STEP 6
150 Y=I-SIN(J)*YMAX
160 SCALE=SCALE+VAR*J+CONST
170 X=X+SCALE
180 IF X>319 OR Y<0 OR Y>191 THEN 200
190 DRAWTO X,Y
200 NEXT J
210 NEXT I
300 GOTO 300
```

The values of "VAR" and "CONST" can be changed to alter the waviness of the drawing.

Screen 4

This screen image was created with the following program and a joystick plugged into connector jack 1. After loading the program and typing "RUN" you will notice a cursor blinking in the middle of the screen; moving the joystick will cause a line to be drawn from this point. If you hold the joystick's trigger button down the movement of the cursor will erase instead of draw.

```
10 GRAPHICS 8+16
20 XMAX=319:YMAX=191
40 X=160:Y=96:CLOR=0
60 SETCOLOR 1,0,10
70 SETCOLOR 2,1,1
270 CLOR=STRIG(0):IF CLOR=0 THEN CLOR=1:GOTO 300
290 CLOR=0:REM BLINK
300 COLOR CLOR:PLOT X,Y
310 IF CLOR=0 THEN CLOR=1:GOTO 330
320 CLOR=0
330 COLOR CLOR:PLOT X,Y:JOY=STICK(0)
340 IF JOY=15 THEN 270
350 IF JOY>=8 THEN 390
360 X=X+1:IF X>=XMAX THEN X=XMAX
380 GOTO 430
390 IF JOY>=12 THEN 430
400 X=X-1:IF X<0 THEN X=0
430 IF JOY<>5 AND JOY<>9 AND JOY<>13 THEN 470
440 Y=Y+1:IF Y>=YMAX THEN Y=YMAX
460 GOTO 500
470 IF JOY<>6 AND JOY<>10 AND JOY<>14 THEN 500
480 Y=Y-1:IF Y<=0 THEN Y=0
500 COLOR STRIG(0):PLOT X,Y:GOTO 270
```

Screen 5

This screen image was created with the program listed for screen 2. The value of "PNTS=19" and "SKIP=1".

Screen 6

This screen image was created using a 3-dimensional plotting program available from Atari. The plotting function is:

$$Z=\text{SIN}(\text{SQR}(X*X+Y*Y))/\text{SQR}(X*X+Y*Y)$$

where: $-17 < x < 17$
 $-17 < y < 17$

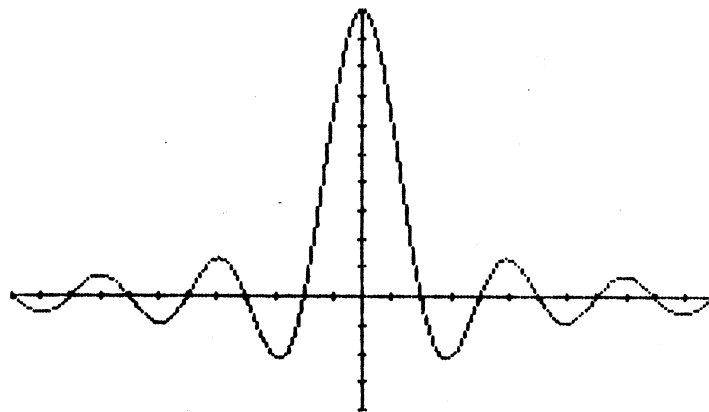
Screen 7

This screen image is a plot of " $Y=\sin(X)/X$ " as created by the following program:

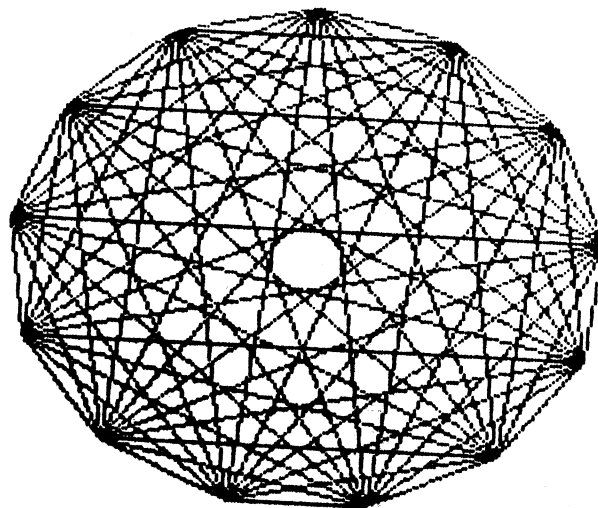
```
1 REM *** SIN(S)/X FUNCTION ***
10 GRAPHICS 8
20 HL=220:VL=150:I=VL/1.4:J=HL/2
30 PI=3.14159
60 SETCOLOR 0,8,0
70 SETCOLOR 2,8,0
80 SETCOLOR 1,8,12
90 COLOR 1
99 REM *** DRAW HORIZ AXIS ***
100 PLOT 0,I:DRAWTO HL,I
110 FOR X=I-1 TO I+1
120 FOR Y=0 TO 24
130 PLOT Y*HL/24,X
140 NEXT Y
150 NEXT X
199 REM *** DRAW VERTICAL AXIS ***
200 PLOT J,0:DRAWTO J,VL
210 FOR X=J-1 TO J+1
220 FOR Y=0 TO 14
230 PLOT X,Y*VL/14
240 NEXT Y
250 NEXT X
299 REM *** DRAW FUNCTION ***
300 RAD :PLOT 0,I
305 U=J/(6*PI)
310 T=12*PI/HL
320 FOR X=-6*PI TO 6*PI STEP T
325 IF X=0 THEN Y=1:GOTO 340
330 Y=-(SIN(X)/X)*I
340 DRAWTO X*U+J,Y+I
350 NEXT X
400 POKE 752,1
410 PRINT "          Y=SIN(X)/X"
420 GOTO 420
```

APPENDIX E - More Examples

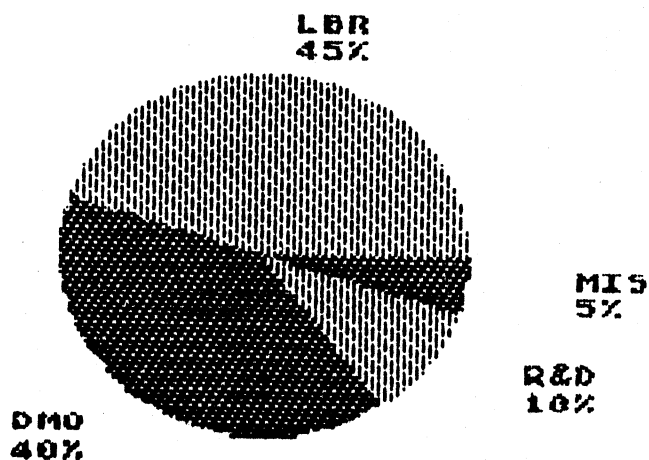
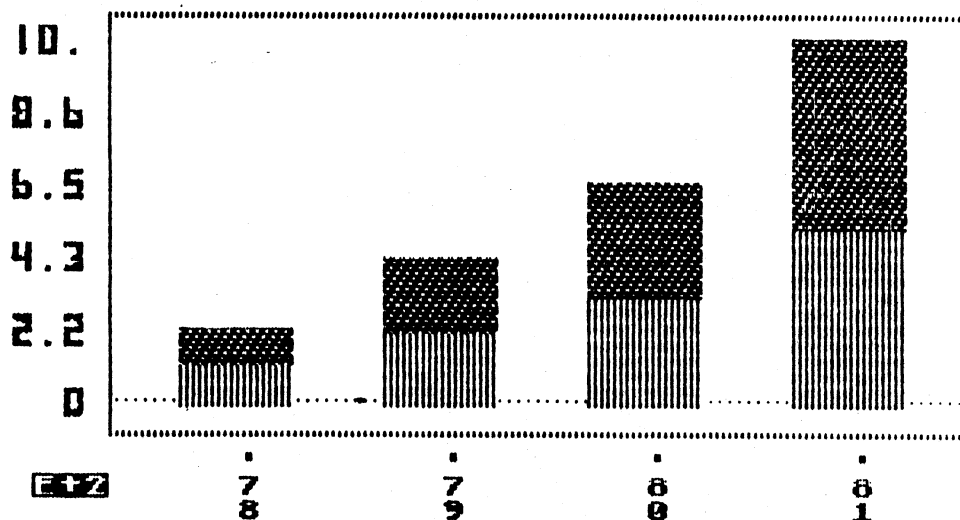
These examples were output on an Epson MX-80 with GRAFTRAX ROM's. The examples marked with an asterisk (*) were created by Versa Computing, inc. using their VersaWriter digitizer drawing board for the Atari Personal Computer. For more information on VersaWriter, contact Versa Computing, inc at 3541 Old Conejo Road, Suite 104, Newbury Park, CA 91320 or phone (805) 498-1965. The font example was created using "FONTEDIT", a program for the Atari Personal Computer which allows the user to create his own font. For more information, contact: The Code Works, Box 50, Goleta, CA. or phone (805) 967-0905.



$$Y = \sin(X)/X$$



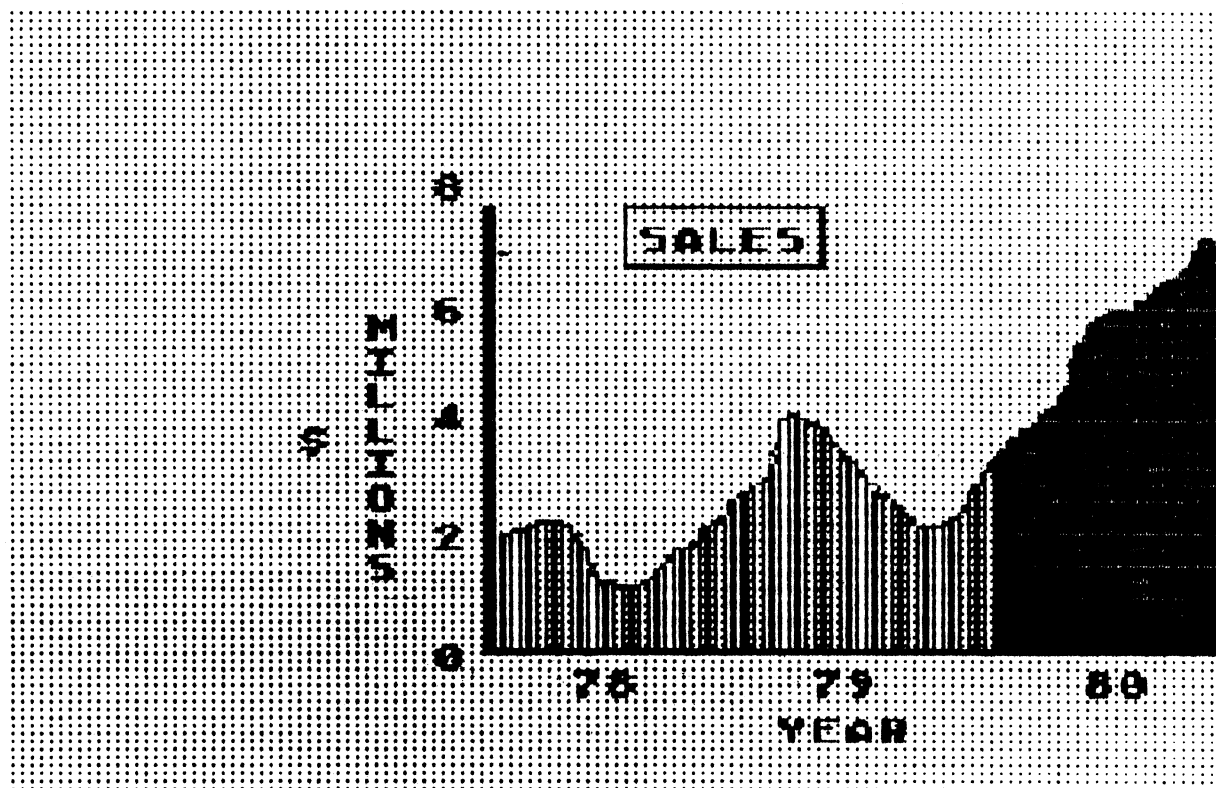
APPENDIX E - More Examples

PIE CHARTS**Cost Distribution****BAR GRAPHS ARE EASY!**

**CUSTOM FONTS ARE EASY WITH FONTEDIT
FROM THE ODGE WORKS AND OF COURSE
USING THE MAGNATRONICS SCREEN PAINT
INTERFACE.**

HERE IS ANOTHER FONT WHICH YOU MIGHT
LIKE BETTER. It is the ATARE font
with a few minor changes to make it
look a little "fancier".

APPENDIX E - More Examples



Make Graphs with VersaWriter
Get hardcopy with MACROTRONICS
Screen Print Interface

QUICK REFERENCE

LPRINT - Direct data to printer instead of your monitor from your basic program.

LIST"P: - Print a "BASIC" program listing.

LIST#P: - Print an "assembly" source listing.

CTRL-P - Print a screen image.

ATARI KEY - Reverse black on white printing of screen image.

RUNFLG - Poke non zero to print. adr=7523

BASIC Subroutine Entry - adr=7513

Vertical Scaling - VMODS=1 to 16. Default=16. adr=7525.

Horizontal Scaling - HMODS=1 to 16. Default=16. adr=7526.

STATUS Byte - Select various options for printout. adr=7513.

If you want to stop the printer before it is done, use the "BREAK" key or "ESC" key - not the "Master Reset".

